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ABSTRACT

This paper provides a brief overview of the LINKS (Learning and Integrating New Knowledge and Skills) Program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University and then details the associated research (evaluation) endeavor. This research effort provides for the assessment of individual attitudes and competencies of preservice teachers, mentor teachers, and instructors in order to refine the four cornerstones of the program--foundations, connectivity, productivity, and integration. Six instruments will be used during the course of the research in order to gather quantitative and qualitative data: the Basic Technology Competencies for Educators (BTCE); the Self-Evaluation Rubrics for Basic and Advanced Teachers Computer Use; the Technology Needs Assessment Survey; the Stages of Concern Questionnaire (SoCQ); the Levels of Use Interview (LoU); and the Open-Ended Statements of Concern. (Contains 16 references.) (MES)

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Integrating Technology at the Pre-Service Teacher Level: Examining the Process of Change

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Abstract: According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12). This paper provides a brief overview of a technology program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University and then details the associated research (evaluation) endeavor. The program described below, as well as the accompanying research, is supported by a US Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

Introduction

The Teacher Education Reform Movement has been at the forefront of debate in colleges of education for many years, and questions about how best to integrate technology into teacher education programs are often at the center of this debate. Recommendations range from efforts to convince student teachers to use e-mail to programs designed to infuse

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technology into every aspect of the teacher education curriculum. E-mail, listservs, and electronic dialogue journals are a few of the recent innovations tried by teacher education faculty in attempts to combat the isolation that preservice teachers often feel. Virtual workshops, out-of-field certification programs, and add-on technology courses have all been implemented with varying degrees of success. Finally, plans to integrate technology throughout the teacher education curriculum have been reported in increasing numbers over the past few years (Drazdowski, 1998; Parker, 1994; Shrum, 1998).

The efficacy of many of these efforts has been called into question. According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). In spite of these reservations, Shaw warns that "limitations in our current knowledge must not be used as an excuse to allow our schools to fall further behind other information-based institutions" (p. 125). Dusick (1998) and Roblyer (1998), among others, agree. While Dusick provides an egalitarian perspective arguing that computers must be placed in schools so that all students will have access (p. 12), Roblyer basically asserts that technology is here to stay whether or not we are prepared for it: "We have a multimedia future, the task at hand is to become fluent in our new native tongue" (p. 53).

An equally important task, as Shaw suggests, is the rigorous evaluation of the programs that we create in order to insure that our students achieve this fluency. However, it is difficult to assess and evaluate when there is no time to reflect, and as Blanchard (1999) claims, "try as we might, technology will not stand still long enough so it can be viewed and reviewed objectively" (p. 1). Since information technology is in constant flux, it becomes imperative to evaluate the use of educational technology as a process of change. A successful technology program is an adaptive one—one that adapts to individual as well as group differences in attitudes, skills, and availability, and one that can quickly accommodate emerging technologies.

This paper provides a brief overview of a technology program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University and then details the associated research (evaluation) endeavor. The program described below, as well as the accompanying research, is supported by a U. S. Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

The LINKS Program (Overview)

The Learning and Integrating New Knowledge and Skills (LINKS) program is designed to support the use of emerging technologies by pre-service teachers within an integrated context of meaningful learning. This context is the field-based teacher education program administered by the PDC, and the technology indicators are tied to specific requirements within that program. The five learner-centered proficiencies tested by the Examination for the Certification of Teachers (ExCET), the Texas Essential Knowledge and Skills (TEKS), and the Professional Development Appraisal System (PDAS) provide the framework for the field-based teacher education curriculum as well as the associated

technology requirement indicators. Competencies related to technology foundations, accessibility, productivity, and integration are documented through course portfolios, classroom logs, desktop conferencing, and professor validation. Students are introduced to specific technology indicators via whole group orientation to the TechTrek Website completing much of their coursework online, and these technology indicators are summarized in the Technology Passport. The Technology Passport assists students, as well as their professors and mentors, in determining and documenting progress toward and mastery of the required technology proficiencies.

The three strands of the LINKS program address the technology needs of future teachers by supporting their development as well as the associated development of mentor teachers and university faculty. Students in professional coursework receive specific instruction on campus as Interns I, II, and Residents as well as extended experience in the field. In field settings, LINKS personnel train technology resource personnel and mentor teachers how best to assist Interns and Residents with technology competencies. Professors of courses leading to certification are provided with technology support and training in the LINKS Center technology lab on the TWU campus. Students may use both university and school technology resources and training opportunities to advance their technology competencies.

The Research (Purpose and Instruments)

The LINKS Program research effort provides for the assessment of individual attitudes and competencies of pre-service teachers, mentor teachers, and instructors. These assessments, in turn, help program developers to refine the four cornerstones of the TechTrek program--foundations, connectivity, productivity, and integration.

Six instruments will be used during the course of this research in order to gather quantitative and qualitative data. These six instruments are (a) the Basic Technology Competencies for Educators (BTCE), (b) the Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use, (c) the Technology Needs Assessment Survey, (d) the Stages of Concern Questionnaire (SoCQ), (e) the Levels of Use Interview (LoU), and (f) the Open-Ended Statements of Concern.

As previously suggested, a successful technology program is a flexible one; therefore, studying the process of change becomes imperative as pre-service teachers adopt and adapt to the use of educational technology to meet the needs of their 21st century students. Three of the instruments listed above address this need.

The SoCQ, the LoU, and the Open-Ended Statements of Concern are all products of the Concerns-Based Adoption Model (CBAM) Project of the Research and Development Center for Teacher Education, University of Texas at Austin, and have been heavily used in the change literature (Fullan & Stiegelbauer, 1991; Fullan, 1993a; Fullan, 1993b, Hord et al, 1987). The CBAM accepts that change is a process and that the successful adoption of any innovation (in this case educational technology) depends on the attitudes, preceptions, and efforts of the individuals who are expected to use the innovation.

All of the instruments used in this study except the Levels of Use Interview will be administered electronically. Quantitative data will be imported into SPSS for analysis, and NUDIST will be used to facilitate the analysis of qualitative data.

The Basic Technology Competencies for Educators (BTCE)

The BTCE is a self-report summated rating scale which is divided into nine competency domains: (a) basic computer operations skills; (b) setup, maintenance, and troubleshooting of equipment; (c) word processing; (d) spreadsheets; (e) database; (f) networking; (g) telecommunication; (h) media communication; and (i) social, legal, and ethical issues (Flowers, 1997). Within each domain five items are given. The fifth item is a summary for that dimension. This instrument measures basic technology competencies (foundations) and will be used as a repeated measure to evaluate participant and group progress.

Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use

The Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use involves seven dimensions that address basic computer use and ten dimensions that address Internet use. Each dimension includes four levels of performance. These dimensions variously represent basic teacher computer use (productivity), Internet use (connectivity), and advanced teacher computer use (integration). These rubrics will be repeated and used to assess progress. They can be found in *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms* (USDE, OERI, 1998), and permission to freely copy and use these rubrics is given.

The Technology Needs Assessment Survey

The Technology Needs Assessment Survey is also available from *An Educator's Guide to Evaluating the Useo of Technology in Schools and Classrooms*. It encompasses one hundred items divided into four areas: (a) personal technology background, (b) staff centered technology, (c) student centered technology, and (d) staff development activities. This measure will be administered only once with each group of participants.

The Stages of Concern Questionnaire (SoCQ)

The *Stages of Concern Questionnaire (SoCQ)* consists of 35 items that use a seven point Likert response form. Analysis of the data results in a profile of the subject's varying intensity of concern at seven distinct stages: (0) Awareness, (1) Informational, (2) Personal, (3) Management, (4) Consequence, (5) Collaboration, and (6) Refocusing (Hall, Wallace, & Gossett, 1973). These seven stages of concern reflect broader categories of self, task, and impact concerns, and the typical progression for the adoption of any innovation is from more intense informational and personal concerns (self), to more intense management concerns (task), and finally, to more intense consequence and collaboration concerns (impact). The individual is most vulnerable, and thus the innovation at greatest risk of failing, when personal concerns are intense. This questionnaire will be administered repeatedly in order to create individual and group profiles and evaluate progress toward innovation adoption.

The Levels of Use (LoU)

The *Level of Use (LoU)* data are collected by individual focused interviews. Analysis of the interview data results in the assignment of a Level of Use rating for each subject. These ratings are closely related to the seven stages of concern. There or three levels of *non* use—Level 0 (Non-Use), Level I (Orientation), and Level II (Preparation)—and five levels of use—Level III (Mechanical Use), Level IVA (Routine), Level IVB (Refinement), Level V (Integration), and Level VI (Renewal). Again, the typical progression for most individuals who are non-users at the introduction of an innovation is from less sophisticated behaviors focused on learning how to use the innovations and/or how to more efficiently manage the innovation to more sophisticated behaviors that reflect a concern for the effects of the innovation on one's students. This interview will be conducted twice in order to describe any behavioral changes.

The Open-Ended Statements of Concern

The Open-Ended Statements of Concern is essentially a writing prompt that provides participants with the opportunity to describe their concerns. They are requested to respond to the following question: When you think about educational technology in the classroom, what are your concerns? Since the SoCQ provides information on the intensity of certain concerns but not on the nature of those concerns, this qualitative procedure is used to increase the investigators' depth of understanding about participants' concerns and will be administered along with the Stages of Concern Questionnaire.

Participants and Procedures

Participants will be the pre-service teachers enrolled in the normal curriculum of TWU's PDC as Interns or Residents, their mentor teachers in the field, and their University instructors (professors, graduate teaching assistants, adjuncts, and liaisons). All pre-service teachers will be expected to participate since self-evaluation and course evaluation are course requirements. Instructors from all parts of the campus who teach courses in the interdisciplinary program or in the education specialties and professional development sequence and all mentor teachers in the PDC's 11 consortium school districts will be invited to participate in this research.

30-40 mentor teachers and 15-20 instructors will be recruited each semester beginning in Spring 2000. Over the 5-semester course of the Preparing Tomorrow's Teachers to Use Technology implementation grant, 150-200 mentor teachers and 75-100 instructors will be involved. Participants will receive whole group, small group, and one-on-one assistance with their technology needs. In addition to advancing their own technology skills, both mentors and instructors will acquire an increased awareness of state-mandated teacher competencies.

Pre-service Teachers

Pre-service teachers will complete four measures: (a) the Basic Technology Proficiencies for Pre-Service Teachers; (b) the Self-Evaluation Rubrics for Basic Teacher Computer Use, for Advanced Computer Use, and for Internet Use; (c) the Stages of Concern Questionnaire; and (d) the Open-Ended Statements of Concern. Students will complete all of these measures at the beginning of each semester as they progress through the field-based teacher education program (three semesters). They will also complete all measures at the end of their final semester, resulting in a total of four repeated measures for each student. Profiles will be developed and evaluated each semester, and those students with high anxiety profiles (i.e., intense Stage 2 Personal concerns) will be contacted and offered appropriate one-on-one interventions. The overall program will be adjusted based on the aggregated results of these analyses. At the end of the three-semester program, ANOVA will be used to assess the overall effectiveness of the program.

University Faculty

Instructors will complete the SoCQ and the Open-Ended Statements of Concern, and they will be interviewed concerning their LoU. The SoCQ and the Open-Ended Statements of Concern will be adminstered during whole group training sessions once at the beginning and once at the end of the semester, and the Levels of Use interviews will be scheduled during these whole group session.

Involved instructors will participate in five whole-group professional development sessions, and if they choose, additional one-on-one sessions which meet their individual needs can be scheduled. The initial whole-group session will consist of an introduction to the LINKS Program and thus to the high levels of technology proficiency expected of pre-service teachers. The second session will be an exploration of the Internet in general, and the final three sessions will cover the use of BLACKBOARD--the University's Web-based course delivery template.

After initial data collection is complete, SoCQ profiles, LoU ratings, and Statements of Concern will all be reviewed in order to determine whether or not planned interventions are appropriate. After final data collection is complete, Wilcoxon Signed RanksTests will be run on the SoCQ and the LoU data in order to assess the practical and statistical significance of any changes. In addition, to the extent possible, these instructors will be followed for an additional semester to determine the scope of their use of the targetted innovation.

Mentor Teachers

Mentor teachers will complete all six measures. The procedures for collection and analysis of SoCQ, Open-Ended Statements of Concern, and LoU data will mirror those used with the instructors. In addition, mentors will complete both the Technology Needs Assessment (once) and The Self-Evaluation Rubrics (twice--once at the beginning and once at the end of the semester).

Mentor teachers will participate in six whole-group professional development sessions in which they will experience the four cornerstones of the LINKS Program—foundations, productivity, connectivity, and intergration—via a WebQuest. Individual needs

identified by Stages of Concern profiles and Open-Ended Statements of Concern will be addressed as needed.

The data from the Technology Needs Assessment will be analyzed along with the initial data from the SoCQ profiles, the LoU interviews, and the Open-Ended Statements of Concern in order to determine whether or not planned interventions are appropriate. If necessary, the overall program will be adjusted based on the aggregated results of these analyses. After final data collection is complete, Wilcoxon Signed Ranks Tests will be run on the SoCQ data, the LoU data, and the Self-Evaluation Rubrics in order to to assess the practical and statistical significance of any changes.

Significance

Concerns about individual attitudes and perceptions have been the focus of many recent research efforts. Medcalf-Davenport (1999) contends that pre-service teachers question the emphasis on technology integration instruction in their teacher preparation courses because they are often times not "exposed to the uses of any technology in the school classrooms as they observe and do field experience" (p. 1424). Medcalf-Davenport further contends that because of a lack of technology-trained faculty, many pre-service teachers do not have an opportunity to have teaching with technology modeled.

Pre-service teachers, in-service teachers, professors, instructors, and liaisons are busy people, and insufficient time is often cited as the reason for the slow integration of technology into the classroom or curriculum. When time is such a crucial element, interventions that do not address specific needs for specific groups of individuals fail. Each participant's concerns and needs must be assessed and promptly addressed in order to make the change process successful. According to Hall and Hord (1987), "the first step . . . is to develop a picture of how each staff member, as an individual, experiences the change process. Only then is it appropriate to aggregate the individuals and plan the change process for all involved staff" (p. 10). This research endeavor attempts to insure that the changes proposed by the LINKS Project are successful.

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